

CLAIMS

1. A semiconductor device for emitting light when a voltage is applied comprising

- a first semiconductor region (3) whose conductivity is based on charge carriers of a first conductivity type,
- a second semiconductor region (5) whose conductivity is based on charge carriers of a second semiconductor type, which have a charge opposite to the charge carriers of the first conductivity type, and
- an active semiconductor region (7A – 7C) which is arranged between the first semiconductor region (3) and the second semiconductor region (5), in which quantum structures (13, 15) of a semiconductor material with a direct band gap are embedded in at least two different configurations which are coupled to each other, and
- an associated switching device (20) for influencing the current flowing through the active semiconductor region (7A – 7C), which is so designed as to switch to and fro at least between a current flow through the active semiconductor region (7A – 7C) with a current intensity (H1) below a given threshold current intensity and a current flow through the active semiconductor region with a current intensity (H2) above the threshold current intensity.

2. A semiconductor device as set forth in claim 1 wherein quantum dots (13) are present as a configuration of the quantum structures and a quantum well layer (15) is present as a second configuration of the quantum structures.

3. A semiconductor device as set forth in claim 2 wherein the quantum dots (13) are of a lateral extent which on average is less than about 50 nm.

4. A semiconductor device as set forth in claim 3 wherein the average lateral extent of the quantum structures (13) is in the range of between 10 and 30 nm.

5. A semiconductor device as set forth in one of claims 1 through 4 wherein the semiconductor regions (3, 5, 7A – 7C) are embodied in the form of semiconductor layers of a layer stack.

6. A semiconductor device as set forth in one of claims 1 through 5 wherein the first semiconductor region (3), the second semiconductor region (5) and the active semiconductor region (7A – 7C) each include $\text{Al}_x\text{Ga}_{1-x}\text{P}$ with $0 \leq x \leq 1$ and the quantum structures (13, 15) are made from a III-V semiconductor material having a lattice constant which is greater than that of GaP.

7. A semiconductor device as set forth in claim 6 wherein the III-V semiconductor material includes InP.

8. A semiconductor device as set forth in one of claims 1 through 7 wherein the switching device (20) is adapted to output current pulses at a pulse rate which the human eye cannot resolve, and includes an adjusting device for adjusting the pulse rate.

9. A semiconductor device as set forth in one of claims 1 through 8 wherein the switching device (20) includes an adjusting device for adjusting the pulse duration.

10. A semiconductor device as set forth in claim 8 or claim 9 characterised in that the switching device (20) is so designed that the current intensity outputted in the case of a current pulse can be changed between two current pulses from a current intensity (H1) below the threshold current intensity to a current intensity (H2) above the threshold current intensity and vice-versa.

11. A semiconductor device as set forth in one of claims 1 through 10 characterised by being in the form of a light emitting diode.

12. A display device having an array-like arrangement of semiconductor devices as set forth in one of claims 1 through 11.

13. A display device as set forth in claim 12 wherein the switching device is adapted to output for each semiconductor device its own switching signal.

14. A display device as set forth in claim 12 wherein each semiconductor device has its own switching device associated therewith.

15. A method of adjusting the color of the light produced by a semiconductor device as set forth in claim 10, wherein light at at least two different wavelengths is alternately emitted in pulse form and a change in the wavelength of the emitted light takes place in such a rapid succession that the human eye cannot resolve the succession.

16. A method as set forth in claim 15 wherein a mixing ratio of the emitted wavelengths is adjusted by the number of the successive pulses at the one wavelength being adjusted in relation to the number of the successive pulses at the other wavelength.

17. A method as set forth in claim 15 wherein a mixing ratio of the emitted wavelengths is adjusted by the duration of the pulses at the one wavelength being adjusted in relation to the duration of the pulses at the other wavelength.